FIG. 1

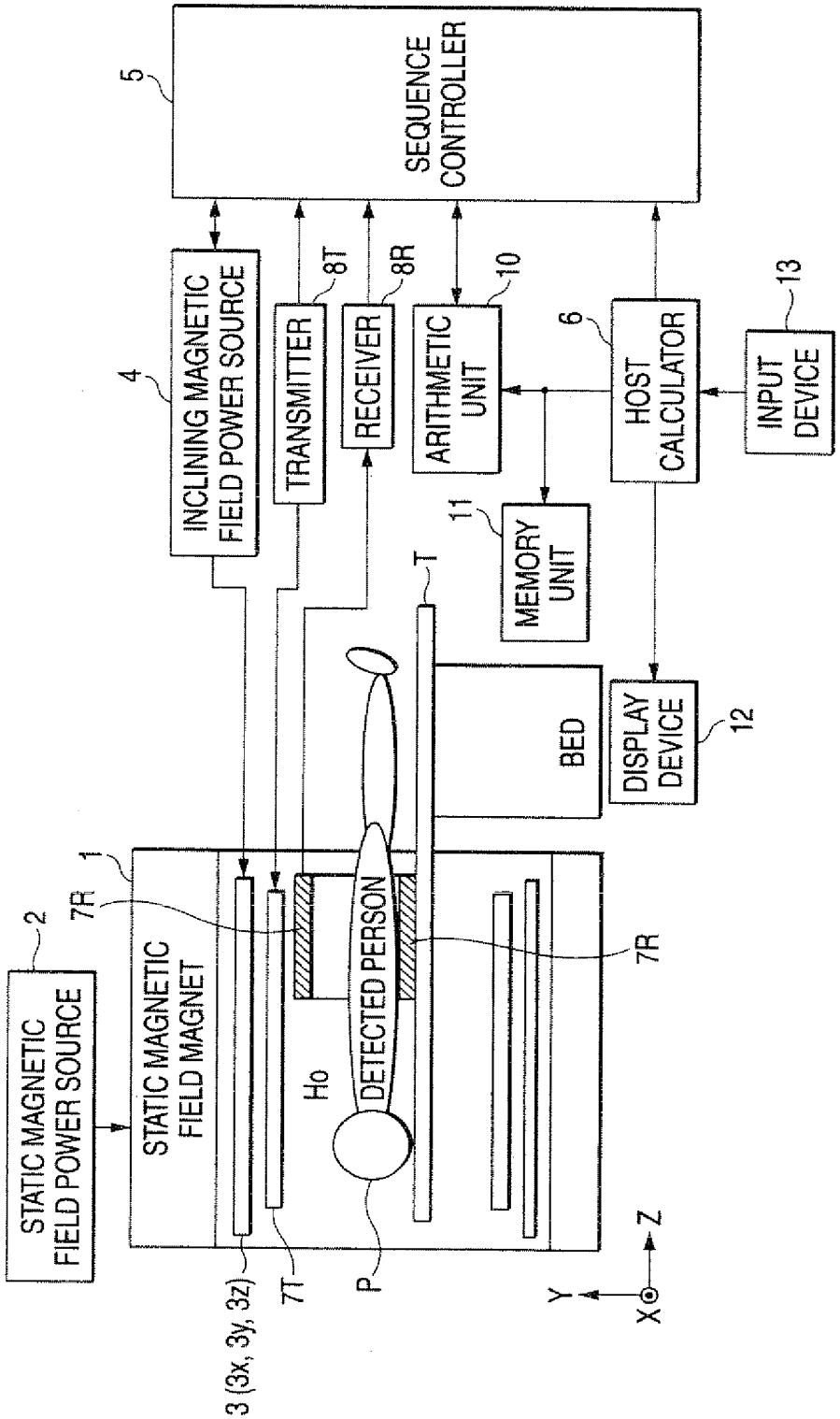

SEQUENCE CONTROLLER
5
INCLINING MAGNETIC FIELD POWER SOURCE
4
TRANSMITTER
8T
RECEIVER
8R
ARITHMETIC UNIT
10
HOST CALCULATOR
6
INPUT DEVICE
13
MEMORY UNIT
11
BED
DISPLAY DEVICE
12
T
STATIC MAGNETIC FIELD POWER SOURCE
2
STATIC MAGNETIC FIELD MAGNET
1
7R
7R
DETECTED PERSON
H0
3 (3x, 3y, 3z)
7T
P
Y
Z
X

FIG. 2

CHARACTERISTICS OF MOTION
IN ABDOMINAL MR IMAGE

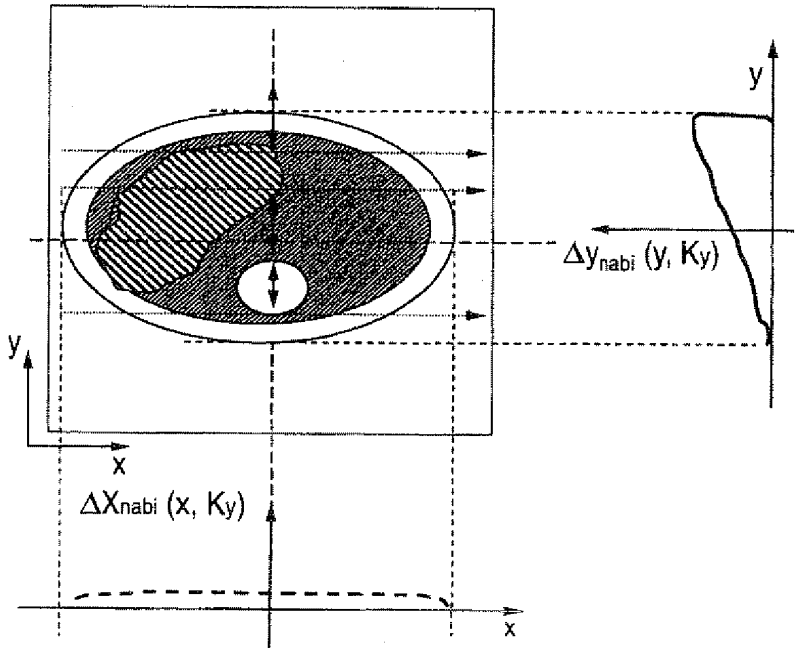


FIG. 3

PULSE SEQUENCE FOR SPIN WARP AND NAVIGATOR ECHO-#1
(IMAGING: R0: x, 1D LINE BY LINE PHASE MEASUREMENT
MODE OF MOVING IN y DIRECTION)

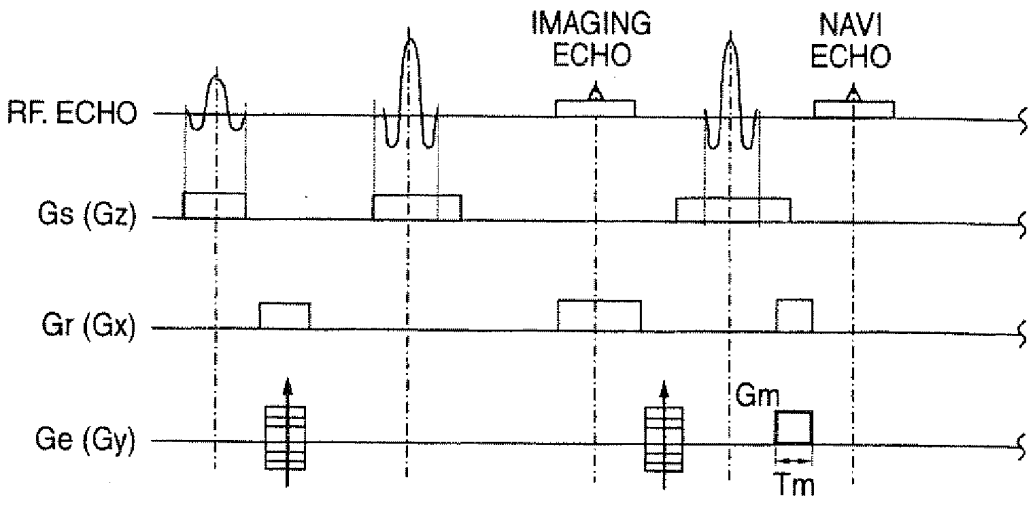


FIG. 4

PULSE SEQUENCE FOR SPIN WARP AND NAVIGATOR ECHO-#2
(IMAGING: R0: x, 0'TH ORDER PHASE MEASUREMENT
OF MOVING IN y DIRECTION)

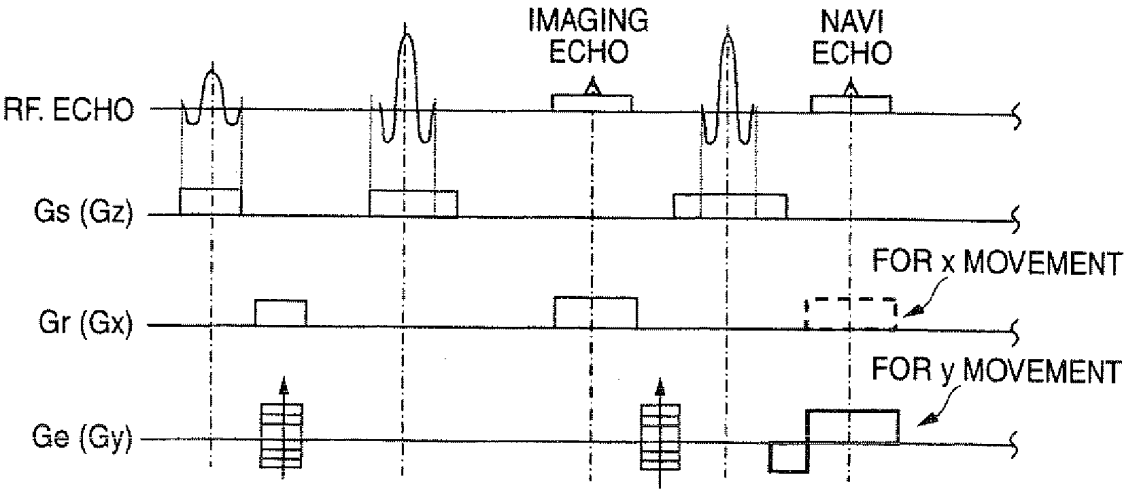


FIG. 5

PROCESSING FLOW DIAGRAM OF NONLINEAR MOTION CORRECTION USING 1D NAVIGATOR ECHO (CASE USING SINGLE COIL)

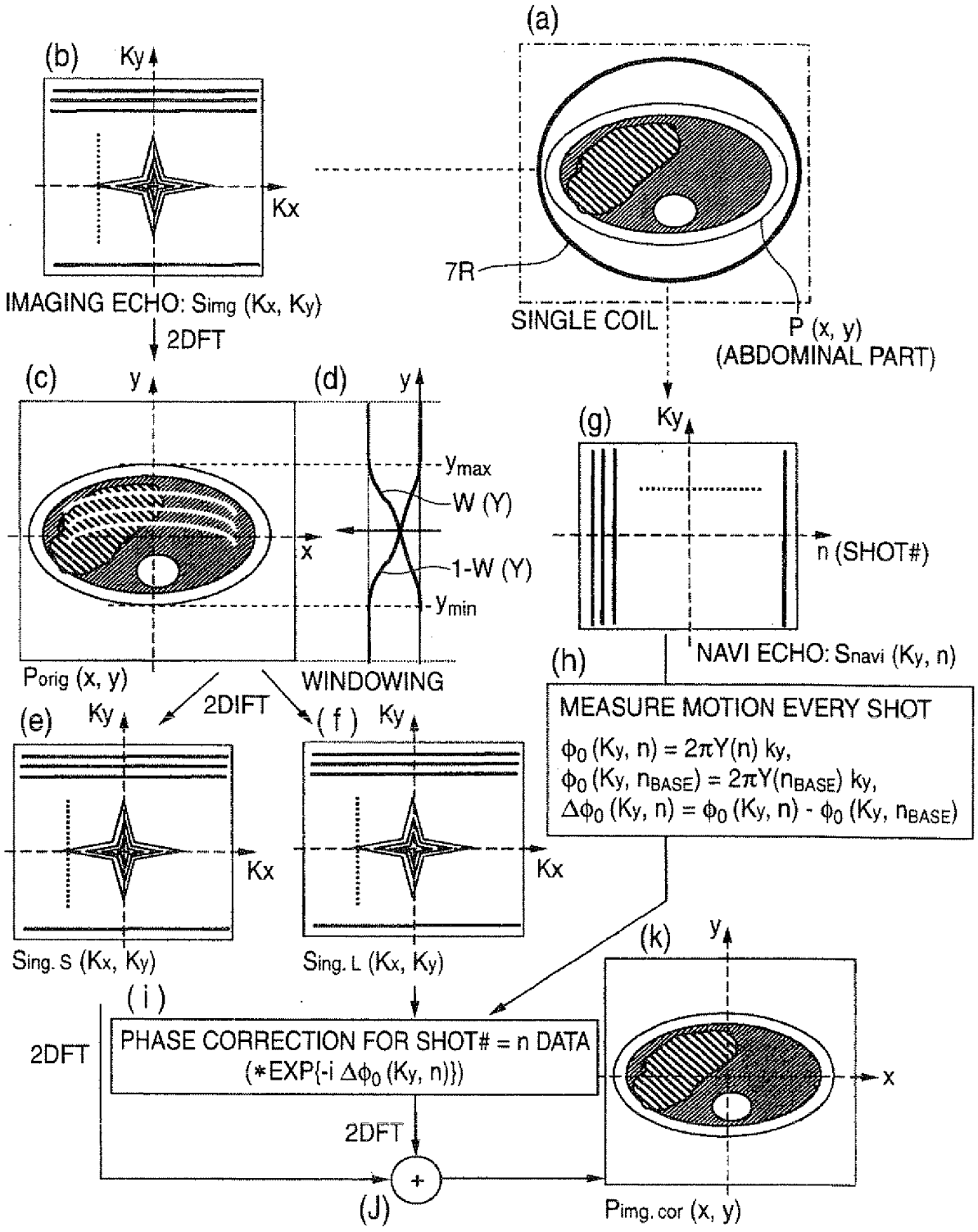


FIG. 6

WINDOW EXAMPLE OF THREE DIVISIONS OF SPATIAL REGION IN PROJECTION PROFILE MEASURING MODE

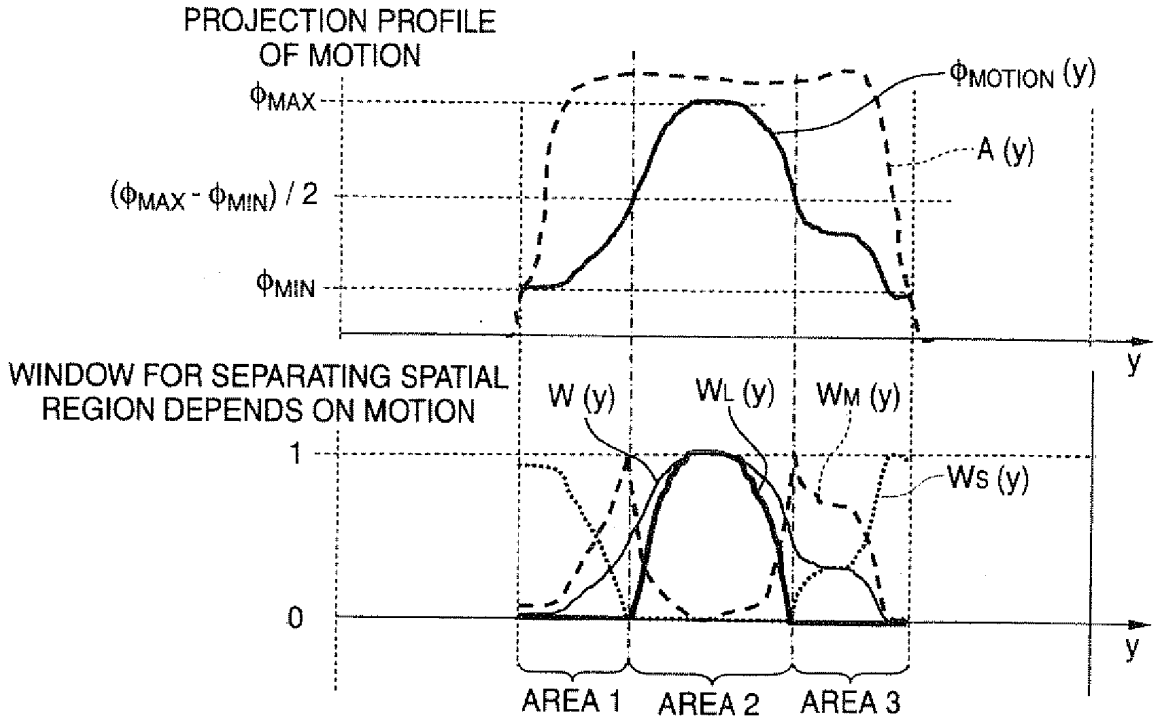


FIG. 7

PROCESSING FLOW DIAGRAM OF NONLINEAR MOTION CORRECTION USING 1D NAVIGATOR ECHO (PROCESSING FLOW OF CASE USING MULTICOIL)

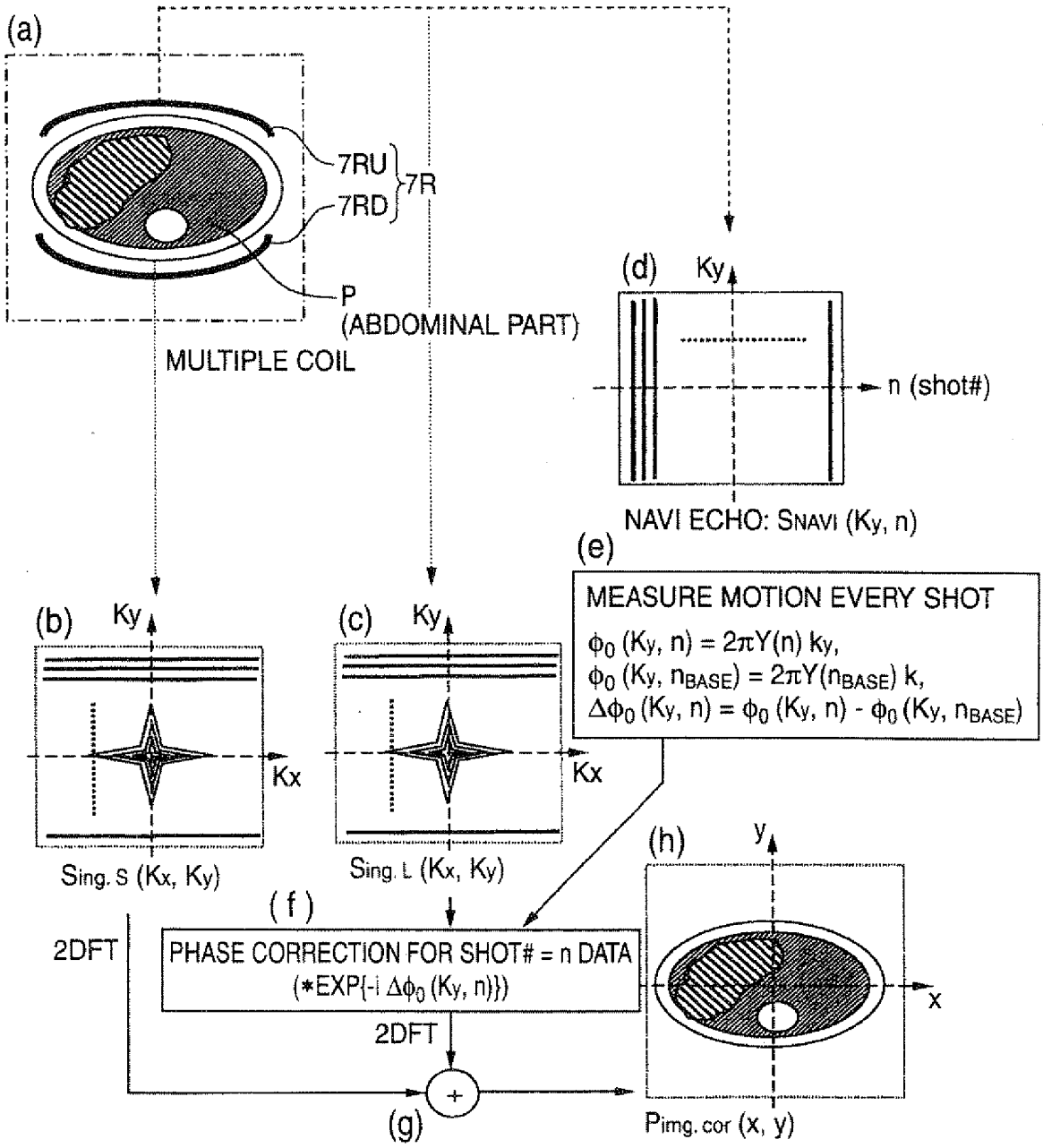


FIG. 8

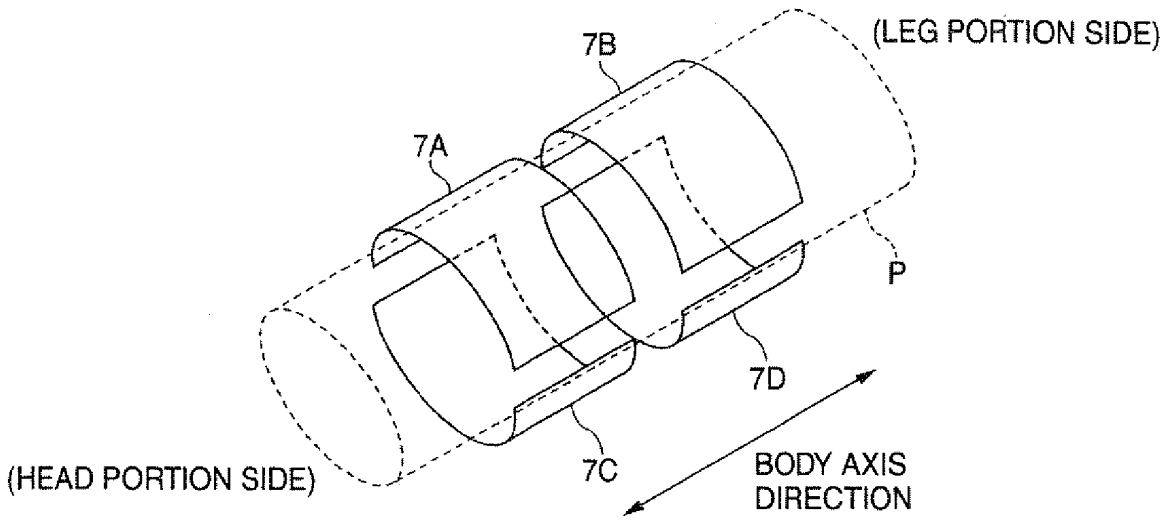

7B
(LEG PORTION SIDE)
7A
P
7D
(HEAD PORTION SIDE)
7C
BODY AXIS
DIRECTION

FIG. 9

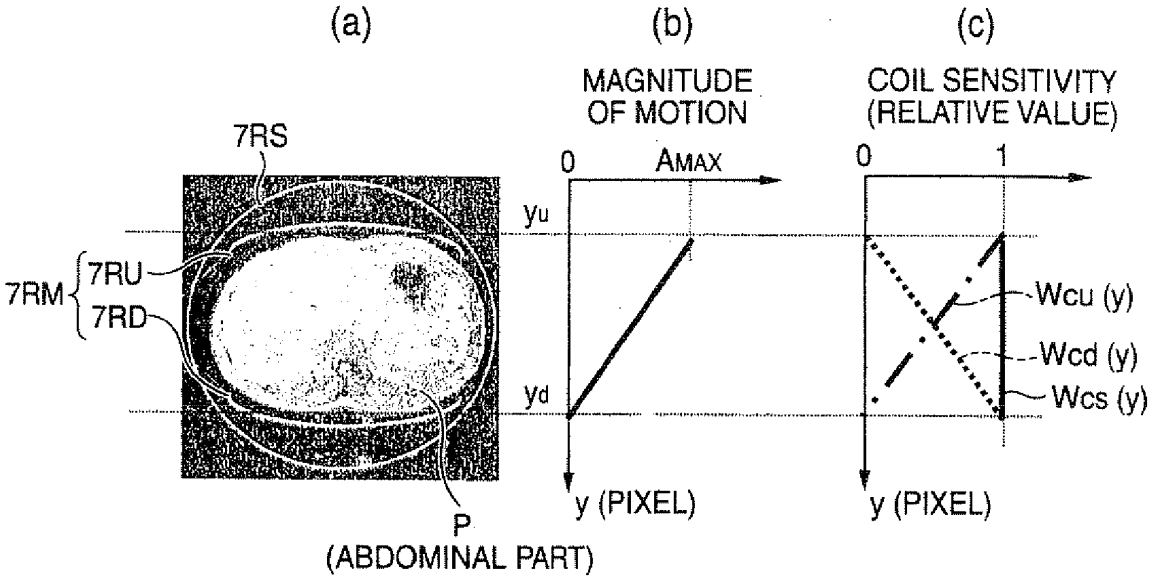

(a)
(b)
(c)
MAGNITUDE OF MOTION
COIL SENSITIVITY (RELATIVE VALUE)
7RS
7RM
7RU
7RD
P
(ABDOMINAL PART)
0
AMAX
yu
yd
y (PIXEL)
0
1
Wcu (y)
Wcd (y)
Wcs (y)
y (PIXEL)

FIG. 10

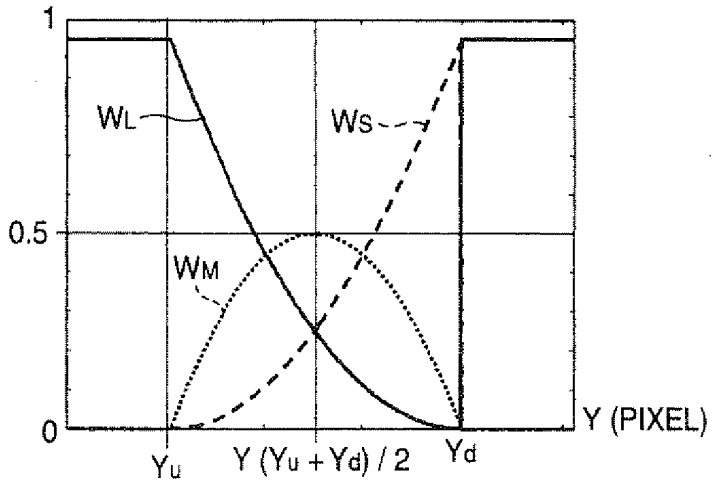

1
0.5
0
WL
WS
WM
Y (PIXEL)
Yu
Y (Yu + Yd) / 2
Yd

FIG. 11

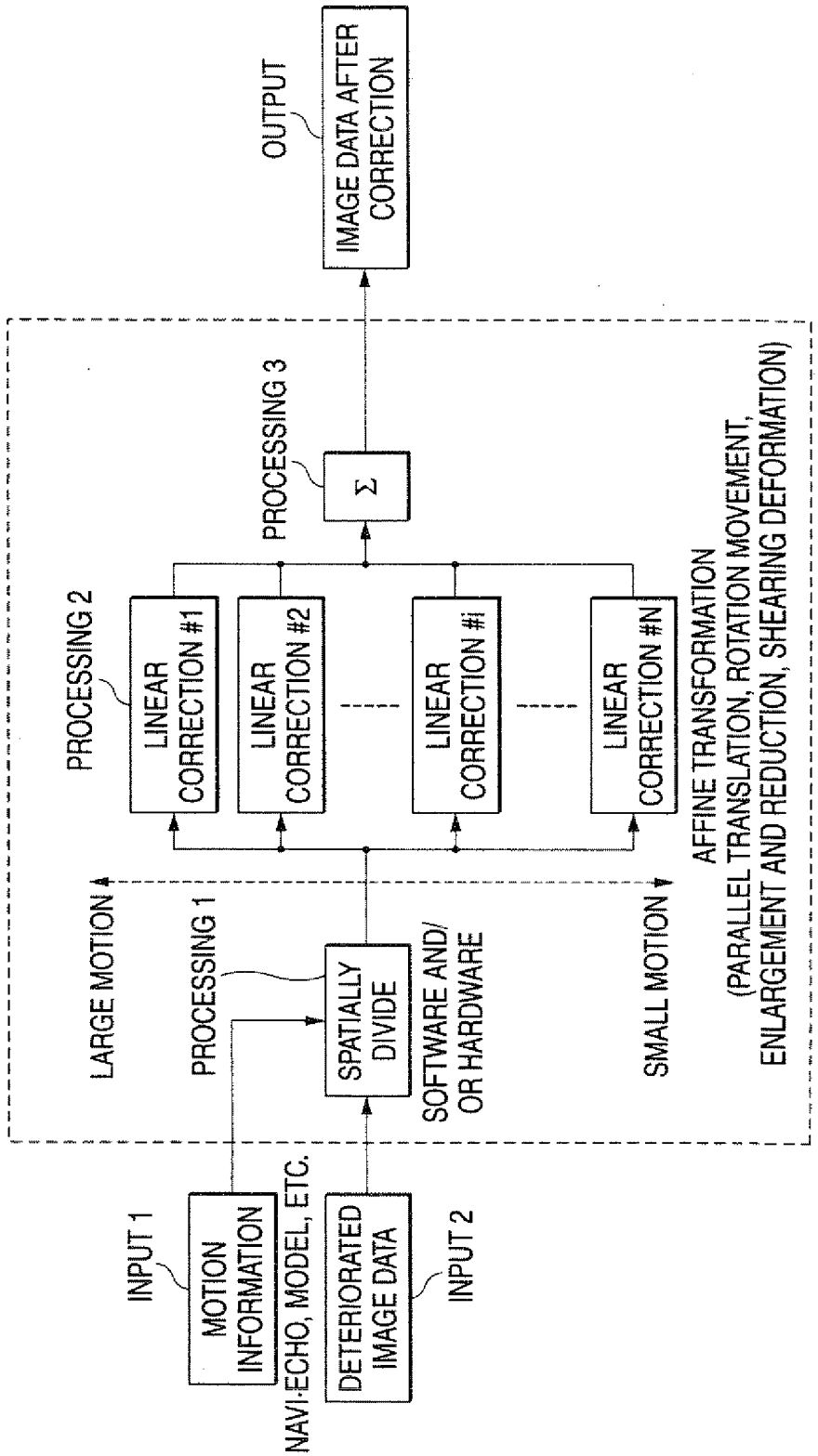

INPUT 1
MOTION INFORMATION
NAVI:ECHO, MODEL, ETC.
DETERIORATED IMAGE DATA
INPUT 2
PROCESSING 1
SPATIALLY DIVIDE
SOFTWARE AND/ OR HARDWARE
LARGE MOTION
SMALL MOTION
PROCESSING 2
LINEAR CORRECTION #1
LINEAR CORRECTION #2
LINEAR CORRECTION #i
LINEAR CORRECTION #N
AFFINE TRANSFORMATION (PARALLEL TRANSLATION, ROTATION MOVEMENT, ENLARGEMENT AND REDUCTION, SHEARING DEFORMATION)
PROCESSING 3
Σ
OUTPUT
IMAGE DATA AFTER CORRECTION

FIG. 12

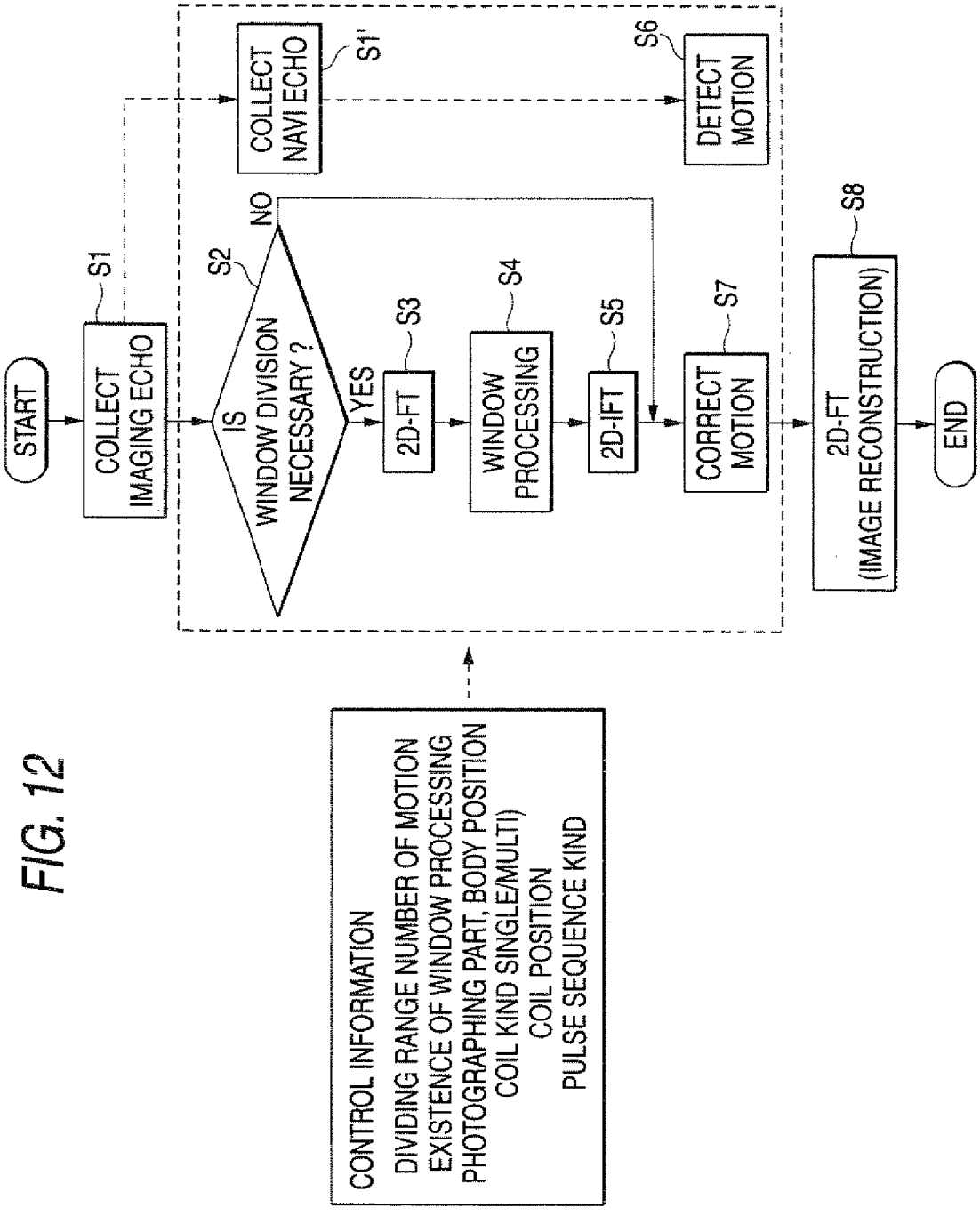

START
COLLECT IMAGING ECHO
S1
COLLECT NAVI ECHO
S1'
IS WINDOW DIVISION NECESSARY ?
S2
NO
YES
2D-FT
S3
WINDOW PROCESSING
S4
2D-IFT
S5
DETECT MOTION
S6
CORRECT MOTION
S7
2D-FT (IMAGE RECONSTRUCTION)
S8
END
CONTROL INFORMATION
DIVIDING RANGE NUMBER OF MOTION
EXISTENCE OF WINDOW PROCESSING
PHOTOGRAPHING PART, BODY POSITION
COIL KIND SINGLE/MULTI)
COIL POSITION
PULSE SEQUENCE KIND

FIG. 13

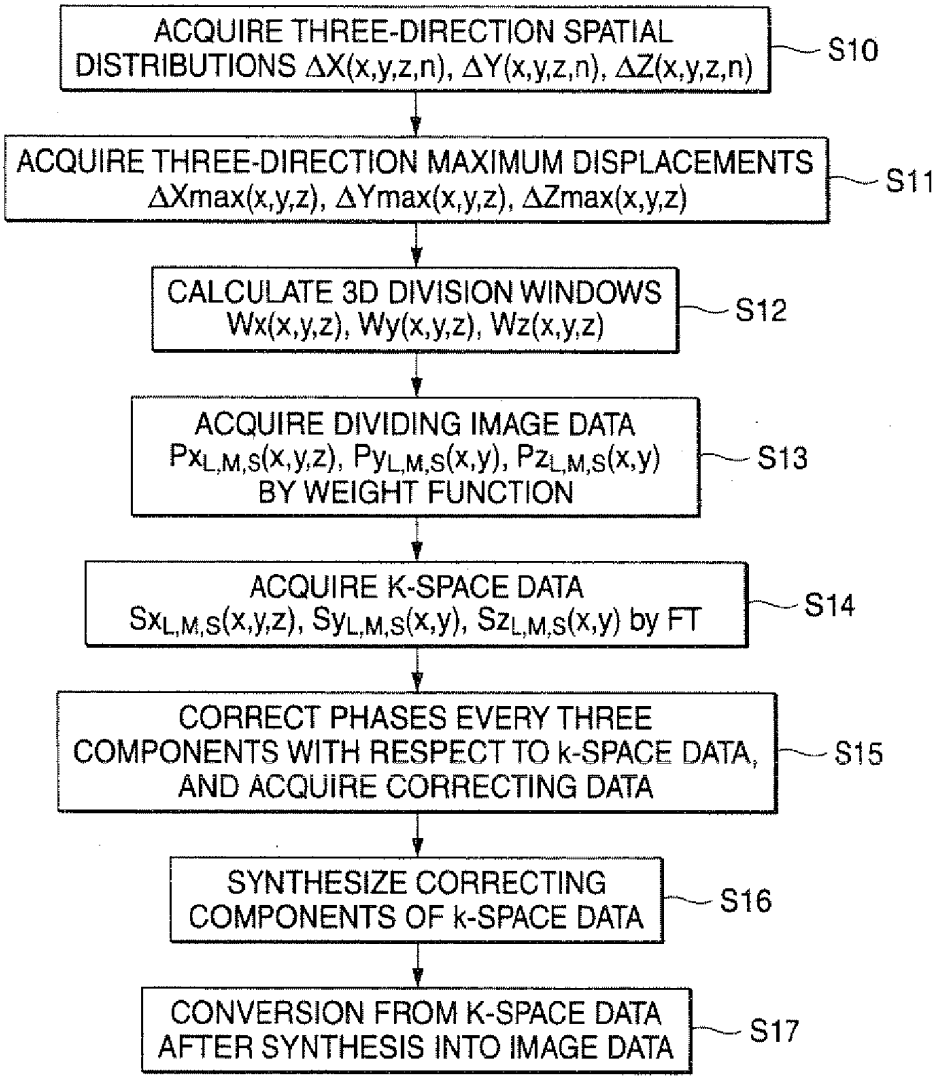

ACQUIRE THREE-DIRECTION SPATIAL DISTRIBUTIONS ΔX(x,y,z,n), ΔY(x,y,z,n), ΔZ(x,y,z,n)
S10
ACQUIRE THREE-DIRECTION MAXIMUM DISPLACEMENTS ΔXmax(x,y,z), ΔYmax(x,y,z), ΔZmax(x,y,z)
S11
CALCULATE 3D DIVISION WINDOWS Wx(x,y,z), Wy(x,y,z), Wz(x,y,z)
S12
ACQUIRE DIVIDING IMAGE DATA Px$_{L,M,S}$(x,y,z), Py$_{L,M,S}$(x,y), Pz$_{L,M,S}$(x,y) BY WEIGHT FUNCTION
S13
ACQUIRE K-SPACE DATA Sx$_{L,M,S}$(x,y,z), Sy$_{L,M,S}$(x,y), Sz$_{L,M,S}$(x,y) by FT
S14
CORRECT PHASES EVERY THREE COMPONENTS WITH RESPECT TO k-SPACE DATA, AND ACQUIRE CORRECTING DATA
S15
SYNTHESIZE CORRECTING COMPONENTS OF k-SPACE DATA
S16
CONVERSION FROM K-SPACE DATA AFTER SYNTHESIS INTO IMAGE DATA
S17

FIG. 14

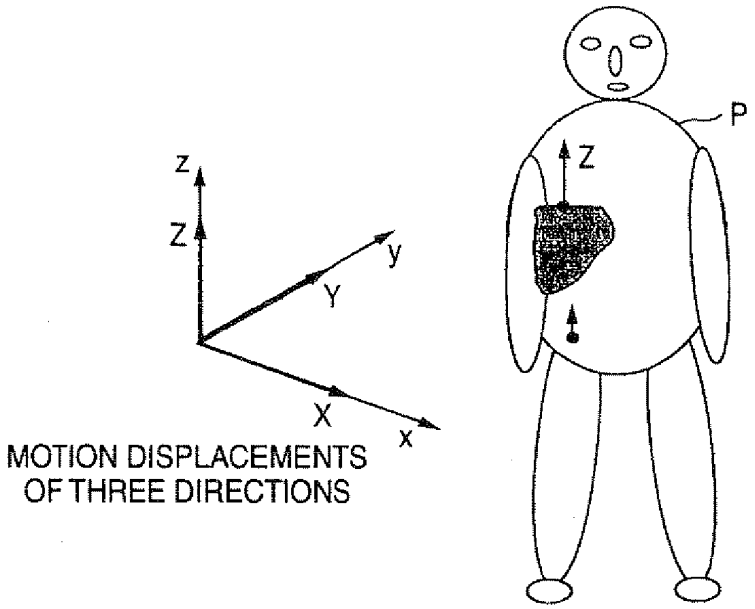


FIG. 15

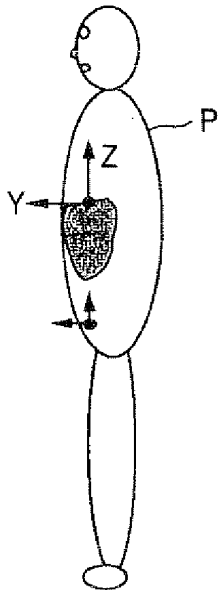


FIG. 16

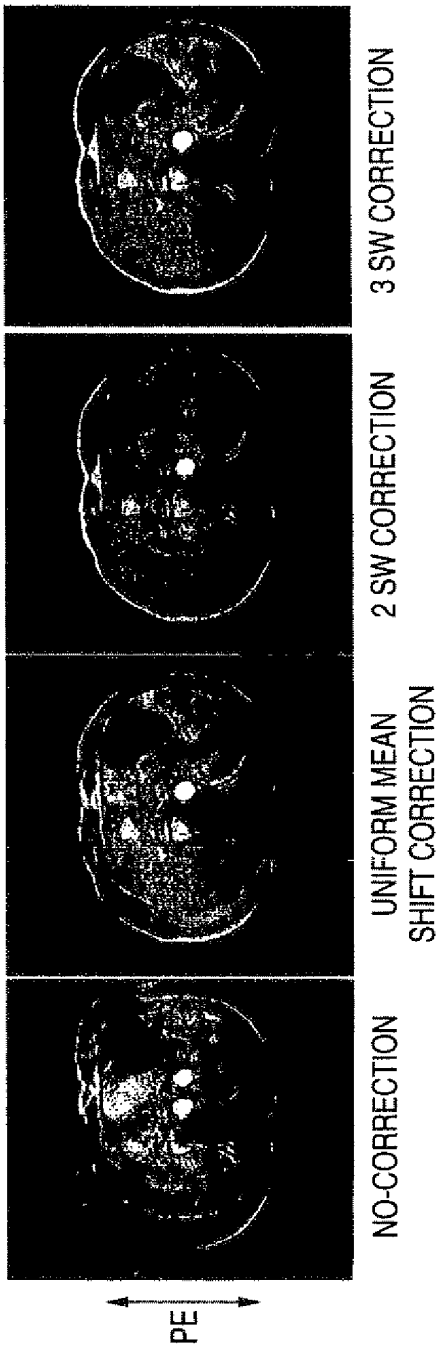
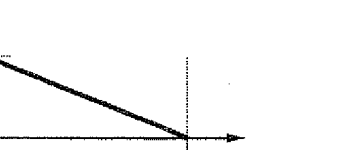
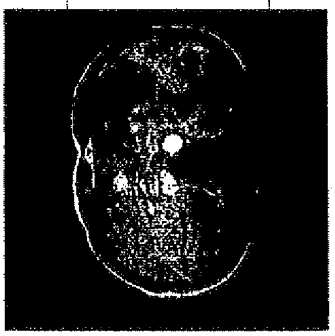
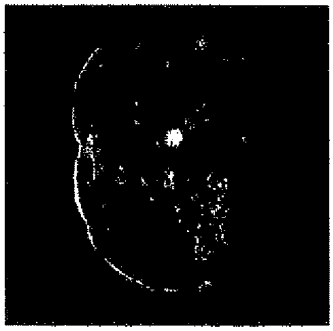

(a)
MOTION
PE
NO-CORRECTION
(b)
UNIFORM MEAN SHIFT CORRECTION
(c)
2 SW CORRECTION
(d)
3 SW CORRECTION

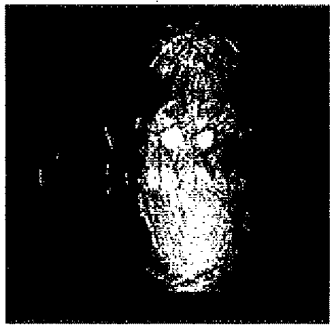
FIG. 17


(e)
MOTION AMPLITUDE
A
0


(d)
3 SW CORRECTION


(c)
2 SW CORRECTION

(b)
UNIFORM MEAN SHIFT CORRECTION


(a)
NO-CORRECTION

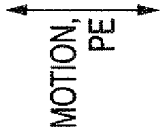
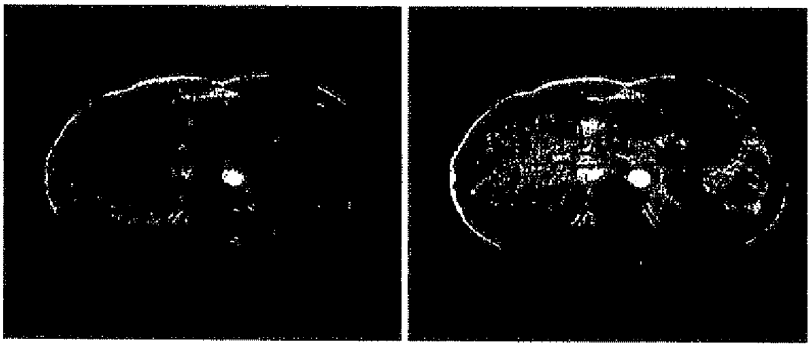

MOTION, PE

FIG. 18

SINGLE-COIL IMAGING

(a) (b)



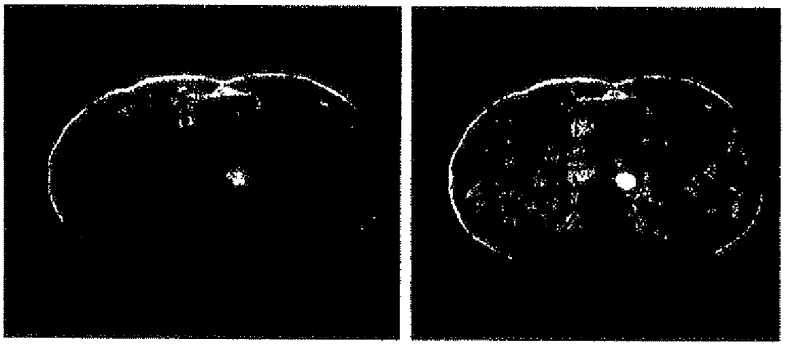
2 SW (INCLUDING AIR) CORRECTION

3 SW (INCLUDING AIR) CORRECTION

FIG. 19

MULTI-COIL IMAGING

(a) (b)



NO SW CORRECTION

+2 SW CORRECTION